

# Conduct Traffic Noise Analysis

Project Development and  
Environmental Analysis Branch



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Version 1

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## **Purpose**

The purpose of the Traffic Noise Analysis Procedure is to evaluate and predict traffic noise impacts and provide feasible, reasonable, and cost effective noise abatement on roadway projects where traffic noise impacts have been identified.

## **Background**

The primary purpose of the Traffic Noise & Air Quality Group is to provide expertise in the area of technical data collection, evaluation, and prediction of traffic noise impacts on proposed highway projects, and the mitigation of identified impacts. All analyses are reviewed to ensure compliance with federal and state regulations pertaining to highway traffic noise. Guidance documents for the highway traffic noise analysis are Title 23, Code of Federal Regulations, Part 772 and the 2004 NCDOT Traffic Noise Abatement Policy. The section also provides coordination and quality control for traffic noise studies undertaken by private engineering firms. All noise mitigation measures that are determined to be reasonable, feasible and cost-effective are included in the highway project design.

The traffic noise analysis includes the following:

- Identification of land uses that may be affected by the proposed highway
- Prediction of traffic noise levels in the vicinity of the proposed alignments
- Determination of traffic noise impacts
- Examination and evaluation of noise abatement measures for reducing or eliminating the noise impacts, giving weight to the benefits and cost of abatement, and to the overall social, economic, and environmental effects

## **Responsibility**

This procedure is the primary responsibility of the Traffic Noise & Air Quality Group of the Human Environment Unit.

## ***Policy, Regulatory, and Legal Requirements***

- [Federal Regulation: Title 23 CFR Part 772 – Procedures for Abatement of Highway Traffic Noise and Construction Noise](#)
- [NCDOT Policy: 2004 NCDOT Traffic Noise Abatement Policy](#)
- [FHWA Policy: Highway Traffic Noise Analysis and Abatement Policy and Guidance](#)

## ***Procedures***

A Transportation Engineer or Technician completes the following **Pre-Fieldwork** procedures:

Step	Action
1	Evaluate received request for work to determine validity and completeness of accompanying documentation.
2	Gather information needed for analysis: <ul style="list-style-type: none"><li>• Appropriate mapping for measurements and fieldwork</li><li>• Predicted AADT Diagram for existing and design year</li><li>• Anticipated speed limits and typical cross-sections</li><li>• Proposed right of way width and type of access control along project</li><li>• Specification of project type: new location or widening (symmetrical or right/left)</li><li>• For design phase work, the preliminary design plans</li><li>• Traffic Noise Analysis Report is used as input for the Design Noise Report</li><li>• No formal public involvement is required by this procedure. All aspects of environmental concern are in the environmental documents presented during the project public hearing. On occasions, someone from Traffic Noise &amp; Air Quality Group may be called in to help support staff during the public hearing.</li></ul>
3	Determine appropriate traffic information [Autos, Medium Truck] & Heavy Truck with their associated speed.  Input all necessary data to develop a Traffic Noise Model (TNM) scenario to determine noise levels for grid receptors for each segment of the project. Determine 72, 67, 66, and 50 dBA traffic noise level contours for each segment of the project using the results of the TNM scenario run and the NCDOT Noise Exposure Spreadsheet.
4	Plot the 66-dBA noise level contour (widening) or 50-dBA noise level contour (relocation projects) on appropriate mapping to determine general noise receptor identification limits.  Determine preliminary and background noise measurement sites in the office through review of land use plans and/or aerial photography.  Check noise monitoring equipment and supplies in preparation for fieldwork procedures.

A Transportation Engineer or Technician completes the following **Fieldwork** procedures:

Step	Action
1	Measure existing noise levels to quantify the existing acoustic environment and to provide a base for assessing the impact of the project. The duration of each measurement site will be 20-minutes with pertinent data collected (i.e., traffic volumes and speed, lane configuration, etc.). In areas where traffic noise is not the predominant source, 2-minute background noise samples will be taken to quantify the acoustical environment of the area.
2	Identify and record all receptors within the project's predicted noise contours on the field data sheet, as necessary, and locate on mapping.

A Transportation Engineer or Technician completes the following **Post-Fieldwork** procedures:

Step	Action
1	Run the TNM to validate measured data.
2	Input a unique numbering sequence, receiver distances, and grid receptor noise levels into the NCDOT Noise Exposure Spreadsheet to determine the project's impacts.
3	Develop a Noise Abatement Criteria Summary, which tabulates the noise contours, noise levels at specified distances, and the number of impacted receptors, by section, of the proposed project.
4	Develop a Traffic Noise Level Increase Summary, which tabulates substantial noise levels increases by sections of the proposed project.
5	For widening projects, prepare a No-Build Alternative evaluation.
6	If appropriate, for large projects, prepare a vicinity map showing project location and ambient field set-ups.
7	<p>Evaluate feasible, reasonable, and cost-effective noise mitigation for impacted receptors:</p> <ol style="list-style-type: none"> <li>1. Use the TNM to validate receptor impacts and determine feasible, reasonable and cost-effective noise mitigation information.</li> <li>2. For Design Phase projects, evaluate each of the subsequent steps (including fieldwork and post-fieldwork procedures), based on current information, and revised where appropriate. In addition, include the following details in analysis and report preparation: <ul style="list-style-type: none"> <li>• Determine the limits of the roadway(s) to be modeled. This is accomplished by measuring the distance from the impacted receptors to the centerline of the roadway, perpendicular to the roadway, and extending this distance, parallel to the roadway, at least four times from the outermost receptors in each analysis area.</li> <li>• Establish a grid system with the x-axis parallel with the project main line to provide common coordinates for all roadways, receivers, and barriers. Horizontal alignment may necessitate establishment of a grid system for each analyzed area.</li> <li>• Straight-line segments will represent the vertical and horizontal roadway alignment by placing roadway points on the representative centerline(s) of directional flows. Intermediate roadway points are determined by developing</li> </ul> </li> </ol>

	<p>straight-line segments with the horizontal roadway alignment on mapping and the vertical roadway alignment on the profile. Straight-line segments must remain within the outer most lane on horizontal alignments and within a foot of the actual profile line on vertical alignments. Establish all points on even station breaks (e.g., +00, +50).</p> <ul style="list-style-type: none"> <li>• Generally, receiver points are located at the corner of the structure (residence, business, school, etc.) closest to the proposed roadway. Multiple points may be necessary to adequately represent larger structures. The ground elevation of each receptor point is determined from topographic mapping, quad sheets or cross-sections. The TNM adds five feet or 1.5 meters to the ground elevation to approximate the height of the human ear.</li> <li>• The potential profile of the barrier can be plotted on the roadway profile. Generally, the barrier is located on or near the right-of-way line or along the shoulder of the roadway, whichever is higher. Barrier points elevations are usually determined using the proposed project cross-sections. Straight-line segments represent the barrier alignment at ground elevations. Establish all points on even station breaks (e.g., +00, +50).</li> <li>• The X- and Y-coordinates of the desired points can be determined either by digitizing the grid or by direct measurement.</li> </ul> <p>3. Develop a Traffic Noise Barrier Summary, which exhibits all noise barriers evaluated and their pertinent information (location, height, length, cost) and the associated benefits provided by each barrier (benefited receptors and cost per benefited receptor).</p> <p>4. When definitive detailed information is available during the design phase of a project, additional tables for feasible, reasonable and cost-effective noise abatement must accompany the Design Noise Report.</p> <ul style="list-style-type: none"> <li>• Develop a Noise Barrier Effectiveness Table, which exhibits ambient receptor noise levels and associated design year noise level changes, both without the barrier and with barrier construction.</li> <li>• Develop a Noise Barrier Description Summary for each feasible, reasonable and cost-effective barrier. Information must include barrier points, beginning and ending stationing, length and height of wall segments, and ground elevation and top of wall elevations at identified points.</li> </ul>
<b>8</b>	<p>Prepare Report:</p> <ul style="list-style-type: none"> <li>• Document all traffic noise impacts and mitigation measures in report format with appropriate supporting data. The noise analysis will contain the assumptions, data, procedures and results from the noise study, as well as the conclusions drawn from it.</li> <li>• Include a comparison of each alternative's noise levels and appropriate noise abatement measures.</li> </ul>
<b>9</b>	Perform internal quality assurance review.

<b>10</b>	<p>Coordinate and distribute report:</p> <ul style="list-style-type: none"> <li>• Traffic Noise Analysis Reports to the Project Development Engineer</li> <li>• Draft Design Noise Reports to the Federal Highway Administration (FHWA) Area Engineer and the NCDOT Project Design Engineer</li> <li>• Incorporate all responses into the final report</li> <li>• Final Design Noise Report to the FHWA Division Administrator for approval</li> <li>• Upon receipt of FHWA approval, send the Final Design Noise Report to the Project Design Engineer for further distribution.</li> </ul>
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## ***Warnings and Precautions***

- Comprehensive understanding of the applicable traffic noise policies, guidelines, regulations and legal references is necessary for anyone conducting traffic noise analyses and preparing the Traffic Noise Analysis and Design Noise Reports.
- Compliance with noise regulations and guidelines is a prerequisite for the granting of Federal-aid highway funds.
- Consideration of noise abatement as part of construction or reconstruction is mandatory whenever traffic noise impacts are predicted.
- Traffic noise analysis can be accomplished based on preliminary project design information. However, as the project progresses, new or changed information may necessitate the analysis or recommendations be reevaluated and updated.
- The FHWA Traffic Noise Propagation Formulas (contained in the Traffic Noise/Air Quality Group Noise Exposure Spreadsheet) are used to identify potential impacts and avoid unnecessary and lengthy analysis. However, potential impacts and corresponding noise abatement measures must be verified using the FHWA TNM.
- Noise analysis required under 23CFR Section 772.17 must use the FHWA TNM, which is described in "FHWA Traffic Noise Model" Report No. FHWA-PD-96-010, including Revision No. 1, dated April 14, 2004, or any other model determined by the FHWA to be consistent with the methodology of the FHWA TNM.

## ***Resources and Tools***

### **Specialized Software:**

- FHWA Transportation Noise Model (TNM-Most Recent Version)
- NCDOT Traffic Computation Spreadsheet
- NCDOT Noise Exposure Spreadsheet
- Highway Capacity Software
- Microstation® for reviewing plans

### **Reference Books, Guidebooks:**

FHWA has several [brochures and pamphlets](#) available for view in html and download in pdf format including:

- Highway Traffic Noise in the United States: Problem and Response
- Highway Traffic Noise

- Keeping the Noise Down: Highway Traffic Noise Barriers
- Entering the Quiet Zone: Noise Compatible Land Use Planning
- Highway Traffic Noise Barrier Construction Trends
- Summary of Noise Barriers Constructed by December 31, 2004
- A Guide to Visual Quality in Noise Barrier Design
- Highway Noise Barrier Design Package

**Other resources available** include:

- [FHWA Traffic Noise Model \(TNM \) Look-Up Tables Software and User's Guide](#)
- [FHWA TNM Version 2.5 software and guidance](#)
- [Insulation of Buildings Against Highway Noise](#)

**Forms:**

- Draft Design Noise Report Transmittal Form to FHWA
- Final Design Noise Report Transmittal Form to FHWA

**Training:**

Specialized training for using the FHWA TNM is available through various sources.

## ***Contacts***

- For suggestions to change this procedure contact: Carl Goode at (919) 715-1515
- For questions about performing this procedure contact: Greg Smith at (919) 715-1607

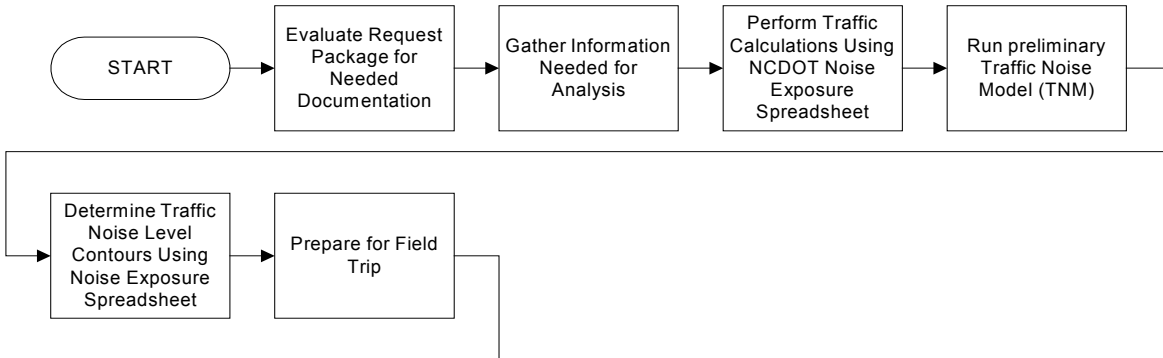
## ***Access Recommendation***

Restricted NCDOT, FHWA, MPO, RPO, Consultants, etc.

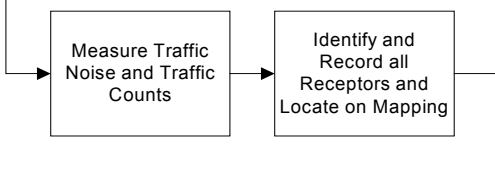
# Flowchart

## Conduct Traffic Noise Analysis

### Pre-Fieldwork Procedures



### Fieldwork Procedures



### Post Fieldwork Procedures

